



# STAR GUNDRILLS



Star Gundrills for  
precision hole making



## SINGLE FLUTE GUNDRILL

The Single Flute Gundrill, with its ability to machine very straight deep holes and hold excellent finishes, was originally developed for gun barrel manufacturing. Today, this tool is a general purpose drill designed for deep hole drilling in virtually any material. The gundrill requires high-pressure coolant through the tool, keeping the cutting edges lubricated, and allowing for adequate chip evacuation down the flute channel.

Star Single Flute Gundrill product line diameter range is .078" [1.98mm] through 1.5" [38.10mm] as a solid carbide head. Larger diameter tools are available using a brazed inserted blade design. All gundrills can be made to any specific length. Lengths over 72" [1828mm] will have an additional weld joint in the body of the tool.

The gundrill is designed to drill holes from the solid, obtain bottom hole configurations and assist in burr-free intersections. The gundrill can achieve precision holes in one pass, eliminating the need for secondary passes, and is a tool for consistent hole-to-hole reproduction.

This tool is unique in its limitations, for machining deep holes are limited to the flute length not the depth of the cut. The design of the Single-Lip, straight deep "V" flutes and high coolant pressure allows for fast, consistent penetration without the need for pecking.

Since the point is not on center, the tool requires either a bushing or pilot hole. Once into the cut, the tool is self-piloting.

The additional advantages of the Single Flute gundrill are:

- Straightness tolerances of .001" [0.03mm] per inch
- Concentricity tolerances of .001" [0.03mm] per inch
- Finish hole diameters as good as +/- .0005" [0.013mm]

## DESIGN FEATURES OF THE SINGLE FLUTE GUNDRILL

Star has a wide range of contours/wear pads that gives the tool the burnishing effect needed to obtain the finish and hole size while controlling heat/friction for a given material.

These features are strategically engineered per application down the outer diameter for the length of the carbide.

Point angles and clearances play an instrumental part in the equation. The proper selection and reproduction of geometry is crucial to its total overall performance. These angles and clearances can be modified to change the cutting performance results and also assist in modifying the high-pressure coolant for better chip flushing or reducing the heat of the cutting edges.

Every material has its own machinability characteristics. With five decades of design and manufacturing experience, Star's gundrill engineering center allows designing the tool to custom fit each application.



**Star Single Flute Gundrill** Used as a general-purpose tool in most drilling applications to obtain hole sized within .001", run-out requirements of .001" per inch, straightness of .001" per foot. This tool has a single flute, 3-piece construction design and has the deepest flute channel, enabling maximum chip evacuation. Diameters are available from .0781 - 1.5".

**Multi Step Gundrill** Star step gundrills are used to produce concentric holes. They can be provided in many diameters and step lengths with a variety of forms on the steps. They are also used to cut a variety of materials. Consult engineering for the length of step and diameter ratio.



## DOUBLE JET GUNDRILLS

Star with its years of experience in gundrilling developed a Star original patented Double Jet Gundrill. The most critical interface in which the carbide is subjected to the most trauma, is during entry and exit of the part. This is caused by the lack of lubricity to the cutting edges. The double jet was designed to combat this type of condition with its unique placement of the coolant holes supplying adequate amounts of coolant to the cutting edge while entering and exiting the part.



Star's Double Jet product line diameter range is .20" [5.08 mm] through 1.5" [38.1mm]. The overall length can be made to any specific length. Lengths over 72" [1828mm] will have an additional weld joint in the body of the tool.

An additional advantage to this style gundrill is its ability to break through intersecting holes and/or enter irregular surfaces without premature wear. The unique coolant hole location also assists in kick off burrs that can occur during break through. As with all gundrills, straightness, concentricity, size and finishes are obtained.



**Star Double Jet Gundrill** A unique Star Cutter design used on interrupted cut applications when coolant is lost during breakout or intersecting holes. This tool allows coolant to be directed on the cutting edge, thus lubricating the corner of the tool and reducing the rubbing forces. Diameters are available from .20" - 1.5."

## SOLID CARBIDE SINGLE FLUTE GUNDRILL

Solid Carbide gundrills have a two-piece construction design. The tip and body are a single piece of carbide brazed into the driver/shank and the flute is ground down the length of the head and body. The absence of the braze joint at the head/body transition eliminates the possibility of coolant obstructions while adding significant strength to the tool.

Solid Carbide gundrills are available from diameter ranges of .055" [1.40mm] to .20" [4.75mm] with lengths up to 12" [305mm]. Larger sizes are achievable upon special request.

The greatest benefit of this type of tool is its rigidity. When a tool enters material, as well as while its drilling, it is exposed to torque forces, or wind-up. This has a detrimental effect on the carbide, resulting in premature wear. The Solid Carbide gundrill strength resists the wind-up forces.

Another advantage of two-piece Solid Carbide gundrill versus the traditional three-piece construction gundrill is the ability to run at much higher feed rates. Many applications yield to high surface footage with conventional style gundrills. The strength of the Solid Carbide gundrill allows penetration at 100% to 200% higher feed rates running at conventional rpms.

STANDARD SOLID CARBIDE GUNDRILL SIZE RANGE	
Diameter Range	Range of Overall Length of Flute
.055" [1.40mm] - .060" [1.52mm]	4" [100mm] - 7" [178mm]
.061" [1.53mm] - .070" [1.78mm]	4" [100mm] - 10" [254mm]
.071" [1.79mm] - .200" [5.08mm]	4" [100mm] - 12" [305mm]

**Star Solid Carbide Gundrill** A two-piece construction design with the head and body consisting of one solid piece of carbide. Commonly used for high penetration rates where maximum tool life can be obtained. Diameters are available from .055" - .20". Lengths are available from 5" - 10".

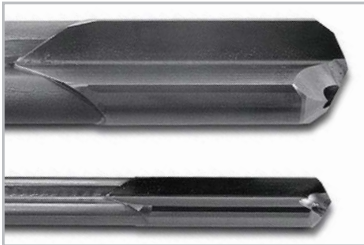


## DOUBLE CRIMP STYLE GUNDRILL

The term Double Crimp is derived from the process of crimping the same tube used for the Single Flute gundrill, only crimping it twice, 180 degrees apart. Since flute channels on this type of tool are shallower than the single flute, chip sizes generated by the tool can limit the types of materials that can be used. The most common materials drilled are cast iron and cast aluminum. The Double Crimp has advantages. First, the coolant holes in the gundrill body are formed by the crimping action, minimizing the coolant turbulence at the head/body transition.

Second, the flutes are equally swaged 180 degrees apart, allowing for much greater rigidity.

The Double Crimp gundrill can obtain feed rates twice that of its single flute partner. This is obtained by two cutting edges opposed to one another and by grinding geometry angles to precise dimensions. With the combinations of geometry, clearances and back taper, the chip load is reduced by 50% and higher penetration rates are obtained. Double Crimp gundrills are available in diameters from .1875" - .5625" with lengths of 72".




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**Star Double Crimp Gundrill** Used for high penetration in softer materials. Cast iron and aluminum are typical materials where the use of two cutting edges allows twice the penetration rate of the single flute design. Diameters available from .1875" - .5625". Lengths are available up to 72"

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## TWO-FLUTE TWO-HOLE DRILL (2F2H) — "MILLED STYLE"

The rigidity of its body differentiates the Two-Flute Two-Hole gundrill from the Double Crimp gundrill. This tool is engineered with a solid steel body, milled flutes and coolant holes produced internally to allow for optimum coolant flow to the tip. The results yield a limited external chip channel and an incredibly rigid

tool. Application dictated, this tool is used in operations that require maximum penetration rates. Like its counterpart, the Double Crimp gundrill, the Two-Flute Two-Hole gundrill's geometries, clearances and back taper are critical to its success. The most common materials drilled are cast iron and some aluminum applications. Two-Flute Two-Hole gundrills are available in diameters from .25" - 2.0" with lengths to 48".




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**Star Two-Flute Two-Hole Gundrill** Like the Double Crimp gundrill, the Two-Flute Two-Hole gundrill is used for high penetration applications where chips are smaller in size. Diameters are available from .25" - 2.0". Lengths are available up to 48".

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## BI-TIP DEEP HOLE TWO FLUTE MILLED STYLE HELICAL GUNDRILL

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Similar to the Two-Flute Two-Hole “milled style” product line engineered with a solid steel body, the Bi-Tip has an auger-like helix ground in the body. This design allows for better chip evacuation in lower coolant pressure conditions.

This enhanced design also allows for higher feed rates and coolant volumes than our

Star traditional design. This tool is designed for the machining of cast/ductile and CGI materials. The Bi-Tip deep hole drill is available in diameters ranging from .315" - 1.0" with maximum flute lengths up to 28".



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***Star Bi-Tip Two-Flute Helical Deep Hole Drill*** Used for high penetration rates in machining of cast, ductile, and compacted graphite materials (CGI) irons. Diameters are available from .315" - 1.0" with maximum flute lengths up to 28."

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## SINGLE FLUTE GUNDRILL COOLANT HOLE CONFIGURATIONS

Star offers three different styles of coolant hole configurations:

1. Single hole - This style is used when the environment is in best conditions. This means that application has adequate pressures.
2. Dual hole configuration – This coolant hole design is recommended for cutting diameters .376" [9.54mm] and greater. This design allows for higher flows, assisting in better chip evacuation.
3. Kidney shaped hole – This style is recommended for cutting diameters under .375" [9.53mm]. Extruded shapes assist in achieving larger gallons per minute out of the front of the tool, thus allowing for better chip evacuation. This coolant hole configuration also can assist when lubricity is minimal.

## COOLANTS

Coolants that run at high pressure are a must in gundrilling. They are used for flushing chips down the flute channel of the tool, cooling the cutting edges and for lubricity. There are three types of coolants used — oil, semi-synthetic and water soluble.

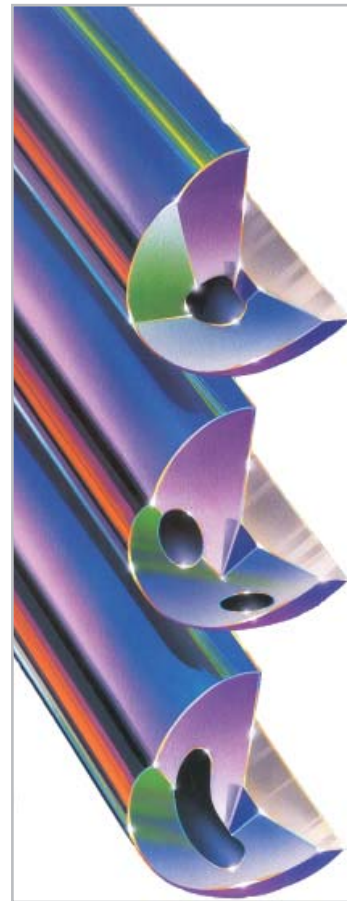
Straight oil is the best type of coolant for tool life, having sulfur and chlorine in the mixture. Sulfur is used for an anti-weld, which helps eliminate buildup on the cutting edge. The chlorine is added to assist as a lubricant allowing for better chip evacuation.

Semi-synthetic coolant is a metal working fluid that is 5-50% mineral oils, water and synthetic chemicals. This coolant has environmental advantages over oil; however, its use can result in shorter tool life.

Water Soluble is a chemical solution that contains no mineral oils. This coolant requires a concentration level to be maintained in gundrilling. It is recommend to maintain this level between 8%-10%, using 10% as ideal condition.

Going from straight oil to water-soluble can cause a 30 to 50% reduction in tool life.

Note: Coolant temperature should be maintained below 120°F.



## RECOMMENDED COOLANT PRESSURES

Size (inches)	Size (mm)	PSI	Bar
.078-.155	1.98-3.94	1500	100
.156-.186	3.95-4.72	1300	90
.187-.217	4.73-5.51	1150	80
.218-.249	5.52-6.32	1050	70
.250-.311	6.33-8.00	925	60
.312-.374	8.01-9.50	775	50
.375-.436	9.51-11.07	675	45
.437-.499	11.08-12.69	600	40
.500-.561	12.70-14.25	525	35
.562-.624	14.26-15.85	500	20
.625-.686	15.86-17.45	450	30
.687-.749	17.46-19.04	425	28
.750-.874	19.05-22.20	400	26
.875-.999	22.21-25.39	350	24
1.000 and up	25.40 and up	300	20



### GUNDRILL SPEEDS AND FEEDS

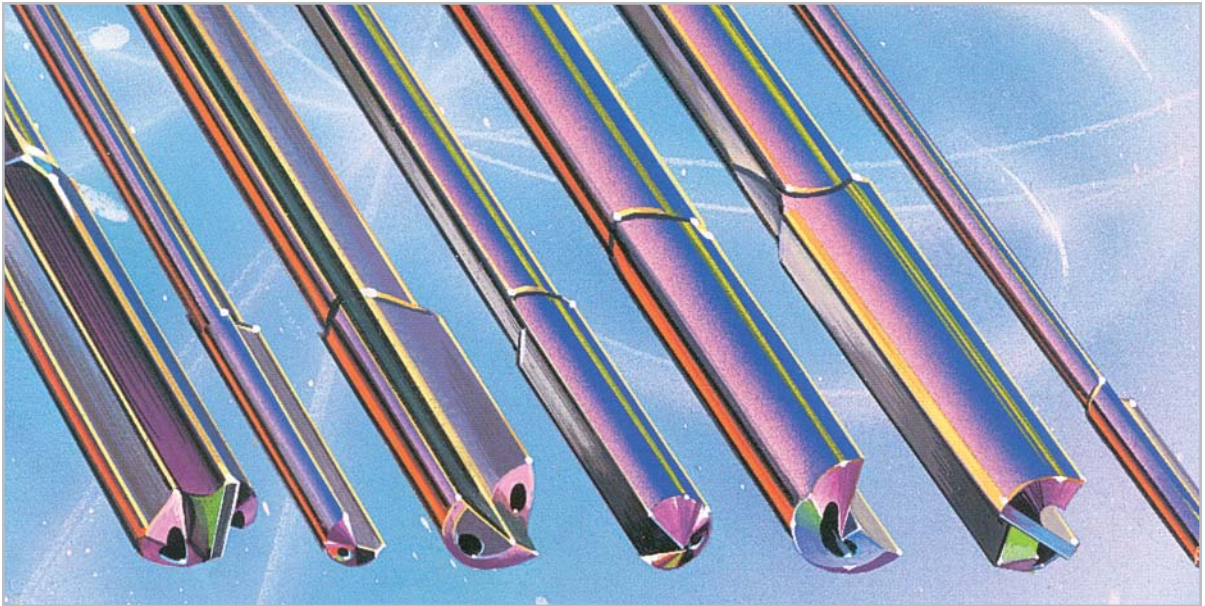
		IRON						ALUMINUM					
DIA	Pressure	Gray Cast			Ductile			Cast 308, 319, 383			Heat Treated 356, 6061, 7075		
		200 SFM			175 SFM			600 SFM			600 SFM		
IN	PSI	RPM	IPR	IPM	RPM	IPR	IPM	RPM	IPR	IPM	RPM	IPR	IPM
0.07840	1500	9,737	0.0002	1.9	8,520	0.0002	1.7	14,000	0.0002	2.8	14,000	0.0002	2.8
0.09370	1500	8,147	0.0003	2.4	7,128	0.0003	2.1	14,000	0.0003	4.2	14,000	0.0003	4.2
0.12500	1500	6,107	0.0005	3.1	5,344	0.0005	2.7	14,000	0.0006	8.4	14,000	0.0005	7.0
0.15620	1300	4,887	0.0007	3.4	4,276	0.0007	3.0	14,000	0.0009	12.7	14,000	0.0006	8.4
0.18750	1150	4,071	0.0009	3.7	3,562	0.0009	3.2	12,214	0.0012	14.7	12,214	0.0007	8.5
0.21870	1050	3,490	0.0012	4.2	3,054	0.0012	3.7	10,471	0.0015	15.7	10,471	0.0009	9.4
0.25000	925	3,053	0.0015	4.6	2,672	0.0015	4.0	9,160	0.0020	18.3	9,160	0.0010	9.2
0.31250	775	2,443	0.0018	4.4	2,137	0.0018	3.8	7,328	1.0025	18.3	7,328	0.0012	8.8
0.37500	675	2,036	0.0020	4.1	1,781	0.0020	3.6	6,107	0.0028	17.1	6,107	0.0014	8.5
0.43750	600	1,745	0.0023	4.0	1,527	0.0023	3.5	5,234	0.0032	16.8	5,234	1.0016	8.4
0.50000	525	1,527	0.0025	3.8	1,336	0.0025	3.3	4,580	0.0035	16.0	4,580	0.0018	8.2
0.56250	500	1,357	0.0028	3.8	1,187	0.0028	3.3	4,071	0.0037	15.1	4,071	0.0020	8.1
0.62500	450	1,221	0.0030	3.7	1,069	0.0030	3.2	3,664	0.0040	14.7	3,664	0.0022	8.1
0.68750	425	1,110	0.0033	3.7	972	0.0033	3.2	3,331	0.0043	14.3	3,331	0.0024	8.0
0.75000	400	1,018	0.0035	3.6	891	0.0035	3.1	3,053	0.0046	14.0	3,053	0.0026	7.9
0.87500	350	872	0.0040	3.5	763	0.0040	3.1	2,617	0.0050	13.1	2,617	0.0028	7.3
1.00000	300	763	0.0040	3.1	668	0.0040	2.7	2,290	0.0050	11.5	2,290	0.0030	6.9

RPM = SFM / (DIA x .262)      IPM = RPM x IPR  
 2 Flute 2 Hole Gundrills / Double Crimp Gundrills, Run at 2 x IPR

STEEL													
DIA	Pressure	Carbon 1010, 1118, 1145			Alloy 4140, 5120, 8620			17-4PH, 15-PH 300 Series			Stainless 400 Series		
		350 SFM			325 SFM			225 SFM			200 SFM		
IN	PSI	RPM	IPR	IPM	RPM	IPR	IPM	RPM	IPR	IPM	RPM	IPR	IPM
0.0740	1500	14,000	0.00015	2.1	14,000	0.00015	2.1	10,963	0.00010	1.10	9,737	0.00012	1.2
0.0937	1500	14,000	0.00020	2.8	13,239	0.00020	2.6	9,173	0.00015	1.38	8,147	0.00015	1.2
0.1250	1500	10,681	0.00280	3.0	9,924	0.00280	2.8	6,876	0.00020	1.38	6,107	0.00020	1.2
0.1562	1300	8,552	0.00038	3.2	7,941	0.00038	3.0	5,503	0.00030	1.65	4,887	0.00025	1.2
0.1875	1150	7,125	0.00046	3.3	6,616	0.00046	3.0	4,584	0.00035	1.60	4,371	0.00030	1.2
0.2187	1050	6,108	0.00055	3.4	5,672	0.00055	3.1	3,930	0.00040	1.57	3,490	0.00035	1.2
0.2500	925	5,344	0.00070	3.8	4,962	0.00070	3.5	3,438	0.00050	1.72	3,053	0.00040	1.2
0.3125	775	4,275	0.00080	3.4	3,969	0.00080	3.2	2,750	0.00055	1.51	2,443	0.00045	1.1
0.3750	645	3,562	0.00090	3.2	3,308	0.00090	3.0	2,292	0.00060	1.38	2,036	0.00050	1.0
0.4375	600	3,053	0.00100	3.1	2,835	0.00100	2.8	1,965	0.00065	1.28	1,745	0.00055	1.0
0.5000	525	2,672	0.00110	2.9	2,481	0.00110	2.7	1,719	0.00070	1.20	1,527	0.00060	0.9
0.5625	500	2,375	0.00120	2.8	2,205	0.00120	2.6	1,528	0.00075	1.15	1,357	0.00065	0.9
0.6250	450	2,137	0.00120	2.6	1,985	0.00120	2.4	1,375	0.00075	1.03	1,221	0.00070	1.9
0.6875	425	1,943	0.00130	2.5	1,804	0.00130	2.3	1,250	0.00075	0.94	1,110	0.00070	0.8
0.7500	400	1,781	0.00140	2.5	1,654	0.00140	2.3	1,146	0.00080	0.92	1,018	0.00080	0.8
0.875	350	1,527	0.00150	2.3	1,418	0.00150	2.1	982	0.00090	0.88	872	0.00080	1.7
1.0000	300	1,336	0.00150	2.0	1,240	0.00150	1.9	860	0.00100	0.86	763	0.00080	0.6



STEEL							
		Tool Steel, Nitralloy, Greek Ascoloy, 316 Stainless, 420, H-13, 455 Custom			416 Stainless, ETD-150 Copper		
DIA	Pressure	200 SFM			275 SFM		
IN	PSI	RPM	IPR	IPM	RPM	IPR	IPM
.0784	1,500	9,745	.00010	.97	13,399	.00010	1.34
.0937	1,500	8,154	.00015	1.22	11,211	.00015	1.68
.1250	1,500	6,112	.00020	1.22	8,404	.00020	1.68
.1562	1,300	4,891	.00030	1.47	6,725	.00030	2.02
.1875	1,150	4,075	.00035	1.43	5,603	.00035	1.96
.2187	1,050	3,493	.00040	1.40	4,803	.00040	1.92
.2500	925	3,056	.00050	1.53	4,202	.00050	2.10
.3125	775	2,445	.00055	1.34	3,362	.00055	1.85
.3750	675	2,055	.00060	1.22	2,801	.00060	1.68
.4375	600	1,746	.00065	1.14	2,401	.00065	1.56
.5000	525	1,528	.00070	1.07	2,101	.00070	1.47
.5625	500	1,358	.00075	1.02	1,868	.00075	1.40
.6250	450	1,222	.00075	0.92	1,681	.00075	1.26
.6875	425	1,111	.00075	0.83	1,528	.00075	1.15
.7500	400	1,019	.00080	0.81	1,401	.00080	1.12
.8750	350	873	.00090	0.79	1,201	.00090	1.08
1.000	300	764	.00100	0.76	1,051	.00100	1.05





EXOTIC MATERIALS (STEEL)										
		K-Monel, Hastelloy B,G,X Incoloy 800-825 Tungsten, Refractoaloy			Waspaloy, A286, Rene, Haynes Inconel, 600, 625, Nimonic			Titanium, 718 Inconel, Molly Nitronic 40-080		
DIA	Pressure	80 SFM			100 SFM			135 SFM		
IN	PSI	RPM	IPR	IPM	RPM	IPR	RPM	RPM	IPR	IPM
0.0784	1,500	3,898	0.00010	0.39	4,872	0.00010	0.49	6,578	0.00010	0.66
0.0937	1,500	3,261	0.00015	0.49	1,077	0.00015	0.61	5,504	0.00015	0.83
0.1250	1,500	2,445	0.00020	0.49	3,056	0.00020	0.61	4,126	0.00020	0.83
0.156	1,300	1,956	0.00030	0.59	2,446	0.00030	0.73	3,302	0.00030	0.99
0.1875	1,150	1,630	0.00035	0.57	2,037	0.00035	0.71	2,750	0.00035	0.96
0.2187	1,050	1,397	0.00040	0.56	1,747	0.00040	0.70	2,358	0.00040	0.94
0.2500	925	1,222	0.00050	0.61	7,528	0.00050	0.76	2,063	0.00050	1.03
0.3125	775	987	0.00055	0.54	1,222	0.00055	0.67	1,650	0.00055	0.91
0.3750	675	815	0.00060	0.49	1,019	0.00060	0.61	1,375	0.00060	0.83
0.4375	600	699	0.00065	0.45	873	0.00065	0.57	1,179	0.00065	0.77
0.5000	525	611	0.00070	0.43	764	0.00070	0.53	1,031	0.00070	0.72
0.5625	500	543	0.00075	0.41	679	0.00075	0.51	917	0.00075	0.69
0.6250	450	489	0.00075	0.37	611	0.00075	0.46	825	0.00075	0.62
0.6875	425	445	0.00075	0.33	556	0.00075	0.42	750	0.00075	0.56
0.7500	400	407	0.00080	0.33	509	0.00080	0.41	688	0.00080	0.55
0.8750	350	349	0.00090	0.31	437	0.00090	0.39	589	0.00090	0.53
1.0000	300	306	0.00100	0.31	382	0.00100	0.38	516	0.00100	0.52



**MAXIMUM UNSUPPORTED DRILL LENGTH**

Example: .250 diameter at 200 sfm = 15"

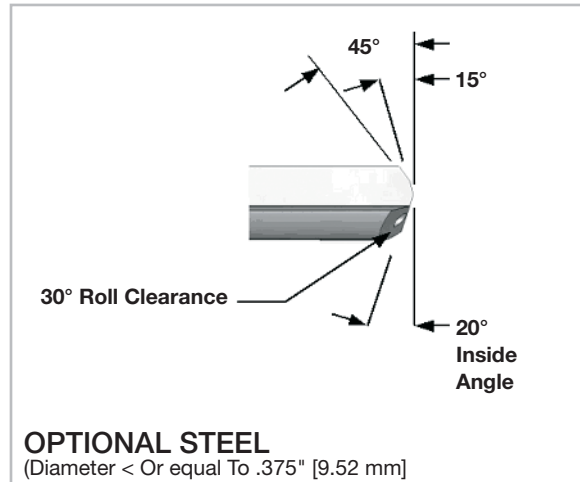
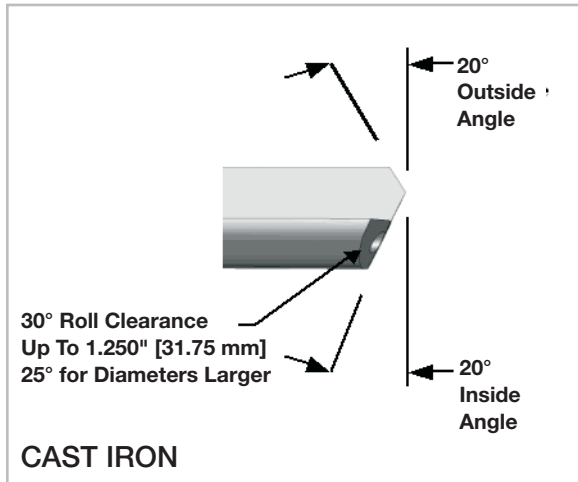
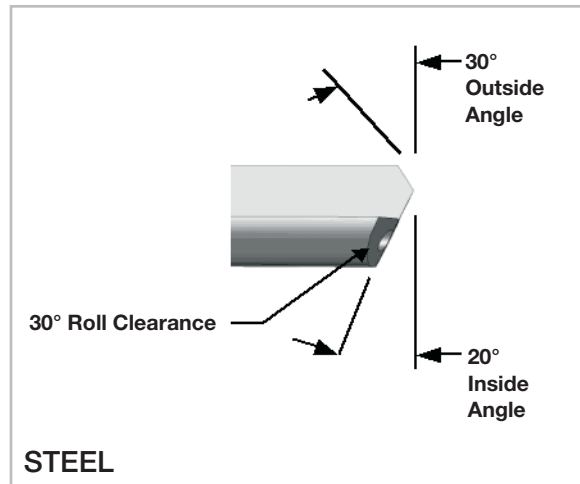
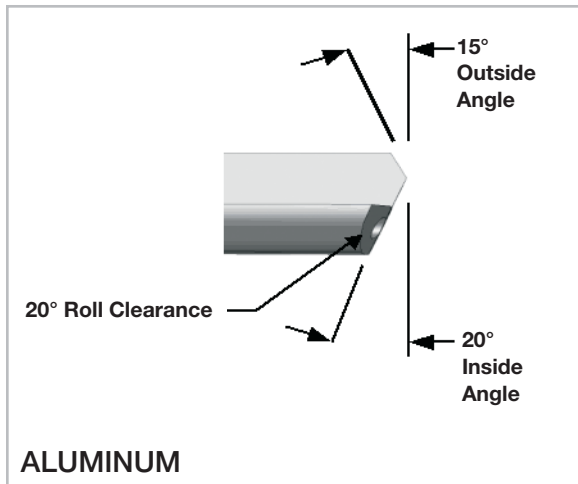
Gundrill Diameter	Surface Feet Per Minute										
	100	150	200	250	300	350	400	450	500	550	600
0.078	6	5	5	4	4	4	3	3	3	2.5	2.5
0.093	8	7	6	5	5	4	4	4	4	3.5	3.5
0.109	9	7	6	6	5	5	5	4	4	4	4
0.125	10	8	7	7	6	6	5	5	5	5	5
0.140	12	10	8	7	7	6	6	6	5	5	5
0.156	13	10	9	8	8	7	7	6	6	6	5
0.171	14	12	10	9	8	8	7	7	6	6	6
0.187	16	14	11	10	9	8	8	7	7	7	6
0.203	17	14	12	11	10	9	9	8	8	7	7
0.218	18	15	13	12	11	10	9	9	8	8	7
0.234	20	16	14	12	11	11	10	9	9	8	8
0.250	21	17	15	13	12	11	11	10	9	9	9
0.256	22	18	16	14	13	12	11	10	9	9	9
0.281	24	19	17	15	14	13	12	11	11	10	10
0.296	25	20	18	16	14	13	12	12	11	11	10
0.312	26	21	19	17	15	14	13	12	12	11	11
0.328	28	22	19	17	16	15	14	13	12	12	11
0.343	29	24	20	18	17	15	14	14	13	12	12
0.359	30	25	21	19	17	16	15	14	13	13	12
0.375	32	26	22	20	18	17	16	15	14	13	13
0.390	33	27	23	21	19	18	16	15	15	14	13
0.406	34	28	24	22	20	18	17	16	15	15	14
0.421	35	29	25	22	20	19	18	17	16	15	14
0.437	37	30	26	23	21	20	18	17	16	16	15
0.453	38	31	27	24	22	20	19	18	17	16	16
0.468	39	32	28	25	23	21	20	19	18	17	17
0.484	41	33	29	26	23	22	20	19	18	17	17
0.500	42	34	30	27	24	22	21	20	19	18	17



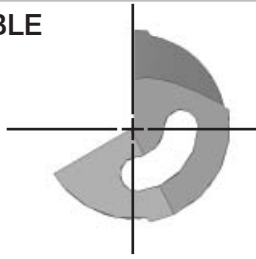
Representative "doodads" and "gadgets" used as chip defectors during the gundrilling operation. Available from Star SU.



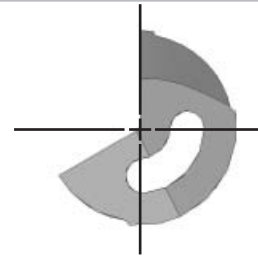
# STANDARD GRINDS



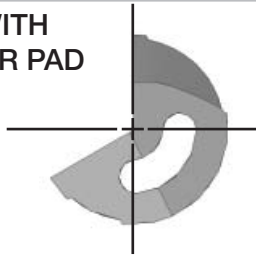
## CONTOUR GRIND GEOMETRIES

**NON-MICABLE**

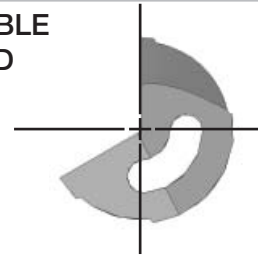
General purpose for all materials. The minimum bearing contact assist the tool from binding in the part.

**MICABLE**

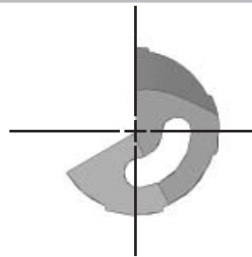
Used in cast irons and aluminum that have cross holes, or require good size control and is good for angular entry.

**MICABLE WITH THIRD WEAR PAD**

Assist in increasing the finish in non-ferrous materials, good for intersecting holes and interrupted cuts where extra OD support and burnishing is required.

**NON-MICABLE WITH THIRD WEAR PAD**

Recommended for all non-ferrous and cast iron gundrills with diameter up to .20" [5.08mm]

**SPLIT PAD**

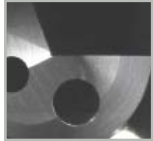
For good size control (including exit), special purpose contour is good for cross drilling, will help in burnishing the bore, and is good for reducing material buildup on the outer diameter.



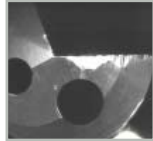
## WEAR CHARACTERISTICS WITH TOOL LIFE IMPROVEMENT AREAS

There are three areas viewed on a gundrill for wear. Point wear, outer diameter wear and face wear. After the tool is pulled from the machine and sent to be reground, all areas should be cleaned to sharp condition. The area most commonly missed is the outer diameter. In many cases, a cutter grinder will not clean this up completely. Essentially

a partially worn tool would not be installed. A good indicator of this is a noticeable difference in tool life from a new tool to the regrind. When changing geometries, or machine parameters, for tool life improvement, Star SU recommends changing one parameter at a time and running controlled tests.



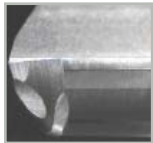
SHARP



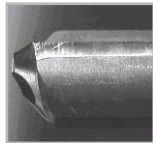
WORN

### POINT WEAR

The point wear is a good indicator of a tool being worn. When the wear on the point starts approaching 1/2 - 2/3 the distance of the margin, the tool is considered worn and needs to be reground. If a tool is experiencing premature tool life in this area, there is a good possibility that the tool has the incorrect geometry.



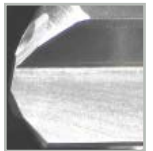
SHARP



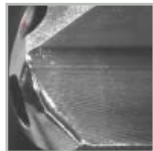
WORN

### OUTER DIAMETER WEAR

If a gundrill is pulled prematurely due to the rounding of this corner, it is a good indicator the tool is being run at too high rpm. Depending on the material that is machined, decreasing the rpm can maintain the surface finish and reduce chip load. Keep in mind that changing the surface finish could affect other wear areas of the tool.



SHARP



WORN

### FACE WEAR

Premature face wear can be caused from cratering or buildup on edges. There are a few potential causes. Check the rpm setting or feed rates. When looking into this, the decision made should coincide with the started surface footage and based on the material being machined. Again, remember changing surface finish could affect other wear areas of the tool. Increasing the outside angle could also improve this area. Coolant Pressure should also be reviewed. Increasing the pressure is another possibility.

## ADDITIONAL TROUBLESHOOTING AREAS

Gundrills today are used in a larger variety of different materials, both ferrous and non-ferrous. Due to this variety of materials and variation in process, a standard table for all materials is not feasible. In many cases, optimizing a gundrill can require adjustment.

Using the recommended starting conditions, it is suggested that adjustments be made from the results of the first hole. The following is a general troubleshooting guide. Only one adjustment should be done at a time to ensure proper understanding of the results.

### HOLE MACHINED OVERSIZED

- Decrease rpm
- Decrease PSI
- Increase outer angle
- Increase IPM

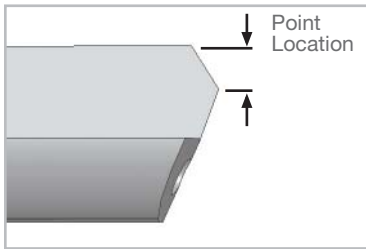
### HOLE MACHINED UNDERSIZED

- Increase rpm
- Increase PSI
- Decrease outer angle
- Decrease IPM

### POOR SURFACE FINISH

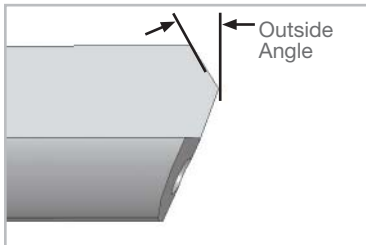
- Increase rpm
- Increase PSI
- Increase outer angle
- Decrease IPM

## SINGLE FLUTE GUNDRILL CHARACTERISTICS



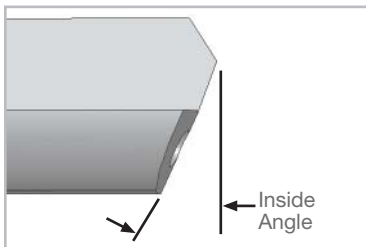
### POINT LOCATION

The point location balances the cutting forces. This dimension is normally held at 25% of the diameter, or  $D/4$ . Putting this dimension less than  $D/4$  will cause the tool to push outwards causing the tool to cut larger. Making this angle larger than  $D/4$  will cause the tool to cut tighter. In some cases this could cause the tool to seize in the part.



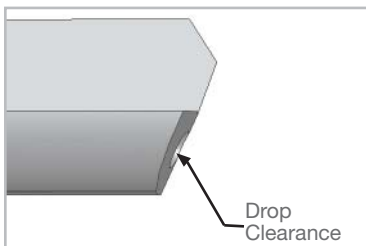
### OUTSIDE ANGLE

The outside angle varies based on the material being machined. This angle is held with a tolerance of  $\pm 1$  degree. This is held to keep consistency from grind to grind for maintaining a constant hole. Increasing ( $15^\circ$  to say  $30^\circ$ ) the angle will assist in the tool cutting straighter, however it will also cut tighter. If the tool cuts too tightly, it could seize in the part and cause tool breakage. If this angle is decreased, the tool will tend to cut freer and wander.



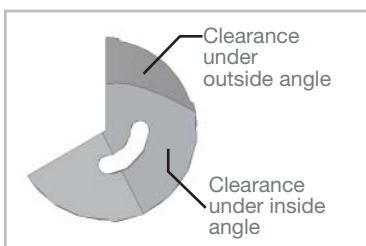
### INSIDE ANGLE

The inside angle is the angle that balances the cutting forces. Increasing this angle will reduce thrust and increase coolant flow. Decreasing this angle will push the drill toward center causing a tighter hole.



### DROP CLEARANCE

The drop clearance is normally a  $20^\circ$  or  $30^\circ$  roll clearance. This clearance is ground in to allow more coolant flow up the flute channel, assisting in chip evacuation. This clearance needs control. Too much clearance could take away too much coolant from the cutting edges, resulting in premature wear on the tool.



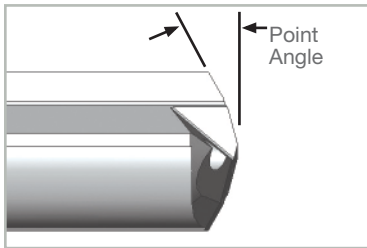
### CLEARANCE ANGLE

The clearance angle is the primary cam relief. Facets are also available for this clearance, and are usually chosen based on the users regrind capabilities.

The clearance under the inside angle is a flat relief grind. This clearance is normally the same as the outside relief.

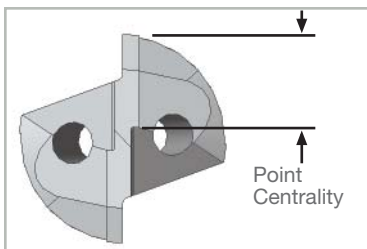


## DOUBLE FLUTE GUNDRILL CHARACTERISTICS



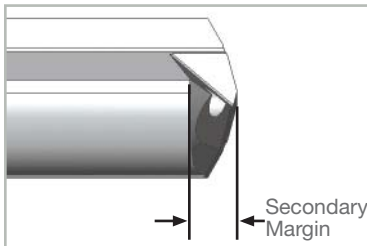
### POINT ANGLE

The “Point Angle” is the cutting angle of the gundrill. The angle is held to  $\pm 1^\circ$  keeping consistency from tool-to-tool and hole-to-hole produced. If the angle is increased, the tool will tend to cut tighter and straighter. Decreasing this angle will cause the drill to cut larger and have a tendency to wander. The cutting lip heights from blade to blade are held within .0005" [0.013mm]. If the lip heights are more, then the tools will have a tendency to fly cut. This will most likely cause an oversized hole to be cut and will cause premature tool wear.



### POINT CENTRALITY

This feature is not forgiving. The point centrality must be held within  $\pm .001$ " [0.025]. The result of being off center is a broken tool at the start of the cut, or if the tool gets into the cut it will start cutting over-size as it gets deeper into the part.

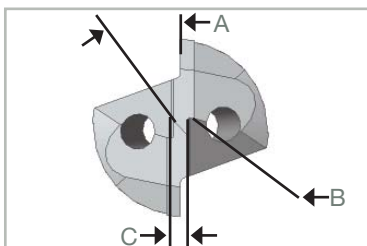


### SECONDARY MARGIN

The secondary margin is a supporting margin to help control size and straightness on a two-flute gundrill. This is the distance the secondary margin trails the cutting margin. The distance held is normally 15% calculation from the diameter of the tool. This dimension is not to exceed .125" [3.18mm].

### CHISEL ANGLE (A)

The chisel angle is controlled by the primary clearance. This angle is the first point of contact as the material is being machined. This angle produces the geometry to make the drill cut.



### NOTCH/GASH (B)

The notch or gash is a clearance to get the chips up into the flute channel. This notch needs to break into the coolant hole  $\frac{1}{4}$  to  $\frac{1}{2}$  of the coolant hole diameter, allowing adequate coolant to assist in forcing the chip into the flute.

### WEB THICKNESS (C)

The web thickness is developed after notch has been ground in. This dimension varies based on the diameter of the tool. It is normally held within 10% – 13% of the cutting diameter.

## TRADITIONAL BUSHING SET UP

There are two materials typically used in making bushings for traditional gundrilling: high-speed steel or tungsten carbide. The preferred choice is tungsten carbide. The high-speed steel will wear out more quickly and has a tendency toward bell mouth from the drill rotating. When a bushing becomes bell mouth it becomes oversized.

When setting the tolerance of the bushing's inner diameter, it should be calculated out taking the large end of the outer diameter tolerance of the gundrill and tolerancing it up  $+.0001 / +.0003$ .

Ex. .2500" diameter gundrill

Bushing ID: .2501" - .2503"

The best practice for locating the bushing to the part is to have it flush against the part. If the process requires a part shuttling in, this will only work using a power bushing. If the setup does not allow for the bushing to go flush against the part, it is then best to leave a gap. The gap in most cases can be judged using a diameter to a diameter-and-a-half away from the part. However, this does not apply to larger diameter drills .750"

diameter and above, and judgement should be used. The purpose of the gap is to allow room for chips to fall out between the part and bushing. There must be enough clearance so the chips do not get caught up in the area, as allowing chips to pack up could result in the gundrill breaking.

A corner break should be ground on the inner diameter of the bushing if it is gapped from the part. This allows for a good lead to the gundrill to re-enter the bushing when it is retracting. This corner break is normally  $.005" - .010" \times 45^\circ$ .

This helps the tool to enter the part with full support from the bushing and will help prevent deflection during the start of the cut. This type of setup is the same as listed previously — flush against the part, gapped accordingly and with a lead on the end for the tool to assist as it re-enters the bushing.

## BUSHINGLESS PROCESS

The bushingless process is used when stationary bushings cannot be installed. This is normally found in machining center applications.

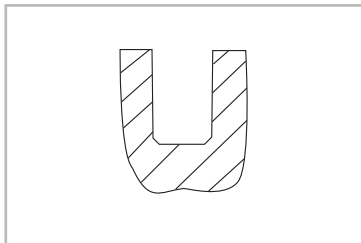
Best practice for non-ferrous materials is to pilot drill a flat bottom. In ferrous materials it is best to match the gundrill point as close as possible. The included angle of the pilot drill is not to be less than the included angle of the gundrill. If the pilot drill angle is more, the gundrill will come in contact at the corner of the gundrill rather than the point where the outside/inside angles meet.

The pilot drill is normally a high performance carbide drill. If the hole requires a chamfer at the end, this can be accomplished by using a step chamfer drill as the pilot drill.

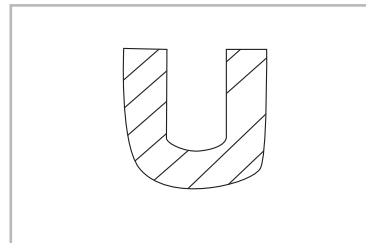
The pilot drill dimensions to the gundrill as shown: 1.5 – 2.0 times diameter deep with  $.0005" - .0010"$  clearances from the outer diameter of the gundrill. If cycle time is needed, an advantage to this process could be to drill your pilot as deep as the carbide drill will allow. Carbide drills run at higher feed rates than gundrills.

Index the drill into the pilot hole and run at very low to no rpms. If programmable, the tools should enter the part in reverse rpms to help protect the cutting edge during entry. The coolant pressure also should be turned off. Once the gundrill is into the part, turn the rpms and coolant pressure on and proceed to cut.

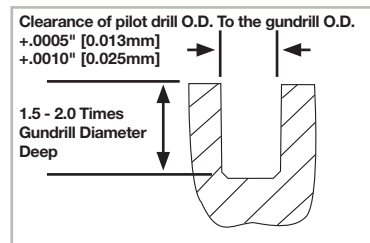
### NON-FERROUS MATERIALS



### FERROUS MATERIALS



### CLEARANCE OF PILOT DRILL O.D.





## STAR SU LLC EXPEDITED SINGLE FLUTE GUNDRILL PROGRAMS:

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Call our toll free number:  
1-877-635-3488

GUNDRILLS

Star SU LLC offers three programs to cover your gundrill needs. When you need gundrills in a hurry, call Star SU LLC for quick results.



### **SOLUTION: 24 HOUR-DELIVERY SINGLE FLUTE STOCK**

When you have an emergency and need stock single flute gundrills in a hurry, you can rely on Star SU to deliver. Star SU carries a large range of stocked gundrills with various diameters, ranging from .078" - .75" in various lengths, delivered within 24 hours.

### **SOLUTION: 24 HOUR-DELIVERY SINGLE FLUTE MOLD TOOL PROGRAM**

Star SU offers a 24-hour delivery service for standard diameter and length mold making gundrills. These mold drills are available in diameters ranging from .1885" – 1.5". Standard 1.25" diameter by 2.75" long drivers apply. If the size you need is not a stocked item, please contact us. We offer an additional expedited program to meet our customers needs.

### **SOLUTION: 72-HOUR (THREE WORKING DAYS) CUSTOMER DESIGN PROGRAM**

Star SU offers custom designed single flute gundrills in diameters ranging from 0.092" – 1.508", **shipped within 72 hours (three working days)**. This program allows special designs for specific diameters, overall lengths, point geometries and contours. Please specify type of material machined at time of order placement to ensure proper design.





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Star SU LLC, Hoffman Estates/Illinois



- Tools Service Center
- Tools Manufacturing Site